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Some Points from the Departmental Report.

We deal fully in this number with the results obtained with various important crops on the Experimental Fields and at the Experimental Stations in this Colony during the nine months from April to December, 1915, but lack of space prevents us from considering so fully the other activities of the Department of Science and Agriculture. For details we must refer our readers to the Report, and content ourselves with brief references to particular points of interest

In the report of the Government Botanist dealing with
In the report of the Government Botanist dealing with summary of the plant diseases of the Colony and their causative organisms—a subject on which Mr. Bancroft is a recognised authority. The effect of the great drought of 1911-12 upon the palms in the Gardens has almost disappeared; and a curious observation on the *Victoria regia* is recorded. The plants in Lake IV. became detached from the substratum and floated on the surface of the water. They showed no sign of again taking root, and eventually all the plants perished. Whether this phenomenon was a seasonal occurrence, or was caused by some injury, is unknown.

The Economic Biologist is able to record that no new serious pest of the sugar cane made its appearance during

the period under review, but on the other hand is unable to say that the already formidable pests show any notable reduction. He insists on careful control work on sound lines and on the conscientious selection of cane tops. No serious outbreak of any of the well-known insect pests of rubber occurred. The coconut pest, *Brassolis sophorae*, however, was much in evidence and a locust, *Tropidacris latreillei*, did considerable damage. "The most remarkable feature of the attack on the Courantyne Coast," says Mr. Bodkin, "was the deplorable lack of interest shown by the inhabitants. The loss of their palms appeared to be a fact entirely beneath their notice, and any suggestions relative to the destruction of the locusts was treated with scorn and contumely. The utility of the Plant Diseases and Pests (Prevention) Ordinance was thus admirably demonstrated." A comprehensive list of plants and products with the animal pests which attack them is given, and a number of valuable hints as to treatment are detailed. We commend this report to the attention of every householder as well as to merchants —especially those interested in the importation of cigars and cigarettes.

The Veterinary Surgeon is in the happy position of being able to report no recurrence of glanders or Mal de Caderas, and the continued good health of the Government stock. In conjunction with the Government Bacteriologist, Mr. Milne treated an interesting case of trypanosomiasis in the Shorthorn bull "Sampson" with "Sodium protosanate," a new remedy from Brazil, with complete success. Some surprise is expressed that the fine stallion jackass is not in greater demand among donkey breeders in the colony.

Mr. S. H. Bayley contributes his usual interesting and satisfactory report on the Onderneeming School Farm, and the Government Botanist adds a short but important account of the Agricultural Instruction imparted, during the period, under the auspices of the Department. Meteorology—which has deservedly received rapidly increasing attention under the present Chief of the Department, so that the Georgetown station now ranks as First Class among the meteorological stations of the world—is also reported on by Professor Harrison and Mr. Bancroft. We hope soon to be able to publish a worthy article on this subject, dealing with the mass of data which has been collected during a period extending over seventy years.

Rubber Results in Ceylon.

THE work of investigation in Ceylon is not yet concluded, but some important results have been obtained. The most noteworthy are as follows (references are to be vulcanized products):—

(1) Acetic acid is on the whole the best coagulant that can be used at present.

(2) Latex allowed to coagulate naturally, without the addition of any coagulant, yields rubber of good quality.

(3) Rubber allowed to remain wet after coagulation (creosote having been added as a preservative) is quick curing and strong.

(4) Washing dry rubber on its arrival in London does not affect the quality.

(5) The addition of creosote does not affect the quality.

(6) Crêpe takes longer to cure (vulcanize) than plain sheet.

(7) Smoked sheet takes longer to cure than plain sheet: thus smoking retards curing.

(8) Plain sheet is often stronger than crêpe, and, in some cases, than smoked sheet.

(9) Smoking would appear in certain cases to affect adversely the strength of the rubber (smoked sheet), but final conclusions as to this cannot be drawn till samples now under examination have been tested.

(10) Repeatedly passing crêpe through rollers does not injure it.

(11) There is little or no difference between thin crêpe and thick crêpe prepared from dry thin crêpe.

(12) It is a matter of indifference, as far as quality goes, whether crêpe is air-dried or dried in hot air or in vacuo.

(13) Making dry rubber into block or roll does not appreciably affect the quality or rate of cure.

TIME OF CURE (VULCANIZATION.)

This is of great importance to a manufacturer, because the best results are only obtained when the cure is perfect. Rubber that is over or under cured will result in inferior quality goods. Large manufacturers make their own preliminary tests to guide them, but small manufacturers are often unable to do this owing to lack of a scientific staff and special plant.

Our samples are, as has been stated, vulcanized at the Imperial Institute. So far, the time required for vulcanizing them has varied from 38 to 140 minutes. This reveals with regard to plantation rubbers a very great factor of uncertainty, which we may, as a result of these investigations, be able to some extent to control.

STRENGTH OF RUBBER.

The diversity in prevailing systems of preparation does not affect the strength of the vulcanized product to the same extent as it does the time of vulcanization. Of 207 specimens, 120 withstood a strain of 2,300lb. per square inch, and 62 of 2,400lb. and over. The breaking strains of two samples of Best Hard Fine Para, tested for comparison, were 2,276lb. and 2,312lb. per square inch, respectively.

EFFECT OF TAPPING ON TREES.

It was at one time believed that tapping had the effect of withdrawing food reserves (starch) from remote parts of the tree, for example, from the roots, and that in the course of time we might be faced with serious debility in trees as a consequence. Our investigations have shown that the depletion of starch cells is usually very local, and that no such apprehensions need be felt. At the same time, the evidence with regard to bark renewal is in favour of a small number of tapping cuts and careful and moderate tapping.

WINTERING TREES.

In Ceylon, rubber trees are generally rested at leaf fall, but the probabilities seemed to be that, regarded from the point of view of the welfare of the trees, Spring was the

proper time to rest them. Our investigations have shown this to be the case; as it is when leaf is being renewed in Spring that the food reserves of the tree are most heavily drawn upon by nature. No depletion of starch cells occurs at leaf fall. The call upon the food reserves of the tree is most severe *during the production of new leaves.*

THE "DESCENDING INCREMENT."

What may be called the "descending increment," that is, the increase in the flow of latex and resulting weight of dry rubber as the tapping cut descends the tree, has been explained by the discovery of the fact that the rows of latex vessels increase in number as we descend the tree, and that this increase has no direct relation to the increase in girth. In some cases the number at ground level was nearly double that at a height of two feet. From there upwards the rows decrease, but not to the same extent. These discoveries not only explain a circumstance of which many planters were aware, but may possibly lead to modifications in tapping which are as yet not contemplated.

—"The Tropical Agriculturist," October, 1916.

Science the Dominant Factor in Education.

What ought to be made clear is that science must form not a mere adjunct but the actual foundation of the education given in secondary schools. In a word, what is wanted is a revolution in our educational system.

Unless the public appreciates the necessity for the change no such revolution is possible; when it does, the mechanism of converting the proposition into action will be simple. If the democracy once understands that we have no chance of keeping our place in the sun unless we are prepared to recognise that whether in peace or war science must be the dominant factor in education all difficulties will disappear. But if this idea fails to take root our place will be lost; and such a place once lost can never be regained. The revelations which have come to light in the course of this bloody war will, we hope, do at least this good, that the people may be induced to appreciate the necessity of basing education upon natural science instead of upon the classics.

—"Nature," February 17, 1916.

Crops on the Experimental Fields—1915.

By Professor J. B. Harrison, C.M.G., M.A., Director; C. K. Bancroft, M.A. F.L.S., Assistant Director; and R. Ward, Agricultural Superintendent.

SUGAR.

The Sugar Cane experiments were carried on at the Experimental Fields under the direct supervision of the Agricultural Superintendent.

In all 3,631 seedlings were raised. Adverse weather conditions which prevailed during the periods of the ripening of the cane-seed and its sowing affected the germination to a marked degree. The total number of seedlings raised was 3,730 or 6,000 less than in the previous year. Of these 505 were possible hybrids; 147 were the product of self-fertilisation; the remainder were obtained by the female-parentage selection of arrows in the field.

The more important varieties crossed were:—

95 x 4399	4399 x 100 Java
95 x 721	4399 x 139 Java
95 x Bourbon	4399 x Red Ribbon
74 x 419	4397 x 139 Java
118 x 625	Bourbon x Red Ribbon
118 x Red Ribbon	625 x Red Ribbon
419 x 4397	Bourbon x 73 Jamaica
419 x 247 Java	721 x 95

NEW VARIETIES.

One hundred and thirty-three thousand seven hundred and seventy seven cuttings of various new varieties of sugar cane were distributed to plantations. The more important of these varieties were:—

Varieties.	Cuttings.
D 118	10,970
D 95	700
D 145	560
D 317	3,960

Cuttings.	Varieties.
D 419	1,240
D 625	250
D 4397	1,114
D 71	3,540
D 581	160
D 450	40
D 141	1,626
D 189	40

RAINFALL.

The rainfall at the Botanic Gardens from January 1st to December 31st was 79.02 inches and of this 13.38 inches fell in the month of February and 17.65 inches in the month of May. In March, September and October the total precipitation amounted to 0.95, 0.66 and 1.20 inches respectively. In each of the other months it exceeded 4 inches. The distribution of the rainfall was, therefore, fairly regular.

CROP RESULTS.

The crops on the Experimental Fields were reaped in November and December. The varieties under manurial trial on the north-east field gave the following results:—

Variety.	Tons of Canes per Acre.				
	No Nitrogen.	*Sulphate of Ammonia.*			*Nitrate of Soda.*
		Low.	*Medium.*	*High.*	
32	34·7	37·2	42 2	48·5	39·5
71	20·9	26·5	31·2	27·4	24·3
47	29·9	30·7	48·6	42·8	34·5
239	13·3	13·6	12·8	17·0	12·5
570	23·4	28·8	29·7	30·4	
367	31·6	32·2	29.5	29·7	
59	29·5	26·5	32·5	37·0	
493	35·8	42·8	40·6	48·9	
Green Transparent ...	46·6	49·1	49·0	50·0	
Means	29·5	32·5	34·6	38·0	

Variety.	Tons of Commercial Sugar per Acre.					
	Saccharose in juice lbs. per gall.	*No Nitrogen.*	*Sulphate of Ammonia.*			*Nitrate of Soda.*
			Low.	*Medium*	*High.*	
32	1·710	3·55	4·30	3·80	4·95	4·00
71	1·856	2·55	3·25	3·80	3·35	2·95
47	1·986	3·47	3·55	5·65	4·95	3·75
239	1·838	1·50	1·55	1·50	1·95	1·45
570	1·569	2·47	3·00	3·10	3·20	
367	1·720	3·23	3·30	3·05	4·20	
59	1·820	3·12	2·80	3·45	3·90	
493	1·723	3·80	4·55	4·30	5·20	
Green Transparent ...	1·809	5·20	5·45	5·45	5·60	
Means	...	3·21	3·53	3·79	4·14	

The comparison of sulphate of ammonia with its equivalent in nitrogen-content of nitrate of soda resulted as follows:—

	Tons canes per acre.	*Tons saccharose in juice per acre.*
	per acre.	juice per acre.
Sulphate of Ammonia	.. 32.4	3.69
Nitrate of Soda	.. 27.7	3·04

The results with the nitrogenous manurings are in accordance with those of former years.

In the above tables low nitrogen is 30 lbs· of nitrogen in sulphate of ammonia per acre, medium nitrogen 60 lbs. of nitrogen in sulphate of ammonia or in nitrate of soda as the case may be, whilst high nitrogen is equal to 90 lbs. of nitrogen in sulphate of ammonia. These rates are equal to 150, 300 and 450 lbs. of sulphate of ammonia per acre respectively·

EFFECT OF SUPERPHOSPHATE.

The usual comparisons on 48 duplicate plots of the effects of dressings of superphosphate were made with the following results:—

Variety.	Tons of Commercial Sugar per Acre.					
	Saccharose in juice lbs. per gall.	*No Nitrogen.*	*Sulphate of Ammonia.*			*Nitrate of Soda.*
			Low.	*Medium*	*High.*	
32	1·710	3·55	4·30	3·80	4·95	4·00
71	1·856	2·55	3·25	3·80	3·35	2·95
47	1·986	3·47	3·55	5·65	4·95	3·75
239	1·838	1·50	1·55	1·50	1·95	1·45
570	1·569	2·47	3·00	3·10	3·20	
367	1·720	3·23	3·30	3·05	4·20	
59	1·820	3·12	2·80	3·45	3·90	
493	1·723	3·80	4·55	4·30	5·20	
Green Transparent ...	1·809	5·20	5·45	5·45	5·60	
Means	...	3·21	3·53	3·79	4·14	

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	Tons canes per acre.	*Tons saccharose in juice per acre.*
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EFFECT OF SUPERPHOSPHATE.

The usual comparisons on 48 duplicate plots of the effects of dressings of superphosphate were made with the following results:—

Plots without nitrogenous manure—

Without Superphosphate	..	28.3 tons canes per acre
With Superphosphate	..	29.2 „ „ „ „

Plots with nitrogenous manure—

Without Superphosphate	..	32.7 „ „ „ „
With Superphosphate	..	33.6 „ „ „ „

The results are confirmatory of earlier trials. In another series of trials the following mean results were obtained.—

Without Superphosphate	..	35.2 tons canes per acre.
With Superphosphate (250 lbs)	.. ..	35.5 „ „ „ „
With Slag Phosphate (600 lbs)	.. ..	39.2 „ „ „ „

Statements have been often made that applications of superphosphate of lime tend to increase the sugar-content of the canes. Our results do not give much support to this contention, thus:—

	Expressed Juice.		
		lbs. per gallon.	
	Specific gravity.	*Saccharose.*	*Glucose.*
Without Phosphate ..	1.0742	1.770	.058
With Phosphate ..	1.0152	1.794	.061

The mean yields of the varieties under trial in this series were:—

Variety.	*Tons canes per acre.*	*Tons saccharose in expressed juice.*
Green Transparent	48.7	5.42
493	42.0	4.46
47	37.3	4.27
32	40.4	4.12
367	33.3	3.45
59	31.4	3.32
71	26.1	3.18
570	28.1	2.94
239	13.8	1.59

IMPORTED AND SEEDLING VARIETIES.

The yields of a considerable number of imported and seedling varieties were tested on South Field. The following are the results of the more promising ones:—

Variety.	Tons Canes per acre.	Specific gravity	Expressed Juice.		
			Saccharose lbs. per gal.	Glucose.	Tons Saccharose per acre.
D 248	34·8	1·072	1·728	·073	3·75
348	19·1	1·080	1·972	·034	2·20
4713	17·9	1·076	1·816	·100	2·10
21	15·3	1·091	2·245	·069	1·95
40	16·9	1·0745	1·796	·043	1·90
189	16·5	1·080	1·894	·062	1·90
453	15·5	1·077	1·915	·037	1·80
757	15·9	1·073	1·801	·059	1·75
49	16·9	1·071	1·650	.125	1·75
168	13·2	1·080	1·978	·047	1·75
581	15·3	1·081	1·983	·046	1·72
482	15·8	1·084	2·014	.024	1·70
225	18·3	1·0745	1·561	·078	1·70
Preta	17 0	1·066	1·515	·080	1 60
Rosa	16 8	1·064	1·510	·089	1.55
293	13·7	1·075	1·786	·083	1·55
165	16·1	1·068	1·536	·066	1·50
Pitu	15·9	1·0635	1 229	·080	1·10

The land on which these trials were made has deteriorated under the constant growth of canes on it year after year so that it is no longer capable of yielding good crops. It will have to be fallowed from cane-cultivation..

PROPOSED TREATMENT OF THE FIELDS.

The crops on the Experimental Fields generally during the last few years have become unsatisfactory and irregular. This is due in the first place to the exceptionally heavy nature of the soil. There is evidence that during the earlier years of the last century this land was regarded as quite unfit for sugar-cane cultivation, and was abandoned; attempts were made about 1864 to bring it under cane cultivation. These failed and the land was again abandoned; whilst in 1889 and 1890 we placed it under experimental cane-cultivation as it was the only land available for this purpose. Part of the land (the South Field) was under continuous cane-cultivation from 1890 to 1913. It is being rested and will be used for replanting in May, 1916, a series of trials having

been designed to test the use of rice-straw on it as a manure and as an ameliorant to the texture of the heavy clay soil. The North-east Field has been under continuous cane-cultivation from 1900 to date. It no longer produces satisfactory crops of cane although it is in better tilth than is the South Field. The North-west Field has the heaviest clay soil of any of the fields and its yielding powers failed after eight crops. Unfortunately it is not possible to place the land under water for a prolonged period, the only certain remedial treatment for such soils.

One-half of the South Field after lying fallow for two years was again brought under cultivation. It was planted with the following varieties:—D 248, D 108, D 493, D 59, D 570, D 181, D 5, D 367, D 239, D 438, 468, Green Transparent and D 118. The last named variety was planted on the North-East and South-west plots of the field with the object of using it as a standard for comparison of the others.

NEW MANURIAL EXPERIMENTS.

A new series of manurial plots was commenced in the North-west Field with the primary object of comparing the manurial value of the nitrogen in animal refuse manure with certain artificial nitrogenous manures, the latter being applied in conjunction with phosphoric acid in the form of superphosphate of lime equivalent to the phosphates contained in the organic manure. The experiment is being conducted in two series, the one using equivalent nitrogen values and the other equal money values of the various manures. The plots received the first application of the manures in January and February of 1916.

SEEDLING RESULTS.

The seedlings raised in 1913 were reaped and the characters of their expressed juices were determined. Many of the seedlings yielded a juice of high saccharine content and purity. Examples of such seedlings raised from uncontrolled parentage are shown in the following table :—

SEEDLING SUGAR CANES FROM SELFED AND UNCONTROLLED PARENTAGE.

Parent (female) Variety.	*No. of Seedlings.*	*Av'ge weight of one cane in pou'ds*	Expressed Juice.							
			Per Cent. by Mill.	*Specific Gravity* 17·5 / 30.	*Pounds per Gallon.*			*Glucose ratio.*	*Quotient.*	
					Sucrose.	*Glucose.*	*Solids not Sugar.*		*Purity*	*Non-Sugar.*
625	661	6·3	64·7	1·090	2·162	·080	·199	3·70	88·5	8·1
	566	7·2	67·3	1 0885	2·156	·062	·189	2 80	89 5	7·8
(selfed)	719	10·0	65·4	1·084	2·115	·053	·114	2·46	92·6	5·0
	706	9·7	64·4	1·088	2·110	062	·216	2·94	88·4	9·7
	655	7·3	62 5	1·085	2·035	·119	·112	5·84	87·8	4·5
	551	6·8	69·4	1·084	2·024	109	·129	5·41	89·9	4·8
	693	6·0	67·5	1·083	1·987	·104	·172	5·26	87·7	7·7
	685	9·2	71·3	1·0835	1 967	·149	·149	7·59	86·8	6·6
	541	7·7	69·9	1·0865	1·962	·092	·298	4·68	84·1	12·7
	556	10·0	62·2	1·0805	1·957	·054	·179	2·75	89·4	7·7
	669	10·3	70·3	1·0805	1·946	·080	·170	4·11	88·8	7·7
	703	7·3	69·4	1·078	1·946	·050	·130	2 56	90·2	6·1
	710	7·7	63·1	1·084	1·941	·054	·277	2·78	86·3	12·1
	657	8·3	67·0	1·0805	1·941	·083	·166	4·27	88·6	7·6
	683	10·0	63·1	1·0785	1·936	·096	·103	4·95	95·7	4·8
	686	10·7	73·1	1·079	1·936	·069	·153	3·56	85·1	7·1
	687	7·5	65·6	1·083	1 926	·113	·215	5·86	85·4	9·6
	574	12·0	68·3	1·079	1·920	·069	·169	3·59	88·9	3·2
	596	7·8	73·0	1·0815	1·920	·104	·191	5·42	86·7	8·6
	652	7·3	71·4	1·082	1·920	·096	·218	5·00	85·9	9·8
	606	7·7	67·0	1·078	1·915	·054	·152	2·82	90·3	7·1
	550	6·0	65·2	1·076	1·905	·071	·090	3·72	92 2	4·3
	673	8·7	74·1	1·0785	1·900	·092	·146	4·84	88 9	6·7
419 (selfed)	42	5·3	67·1	1·094	2·266	·080	·202	3·53	88·6	8·0
	855	6·8	70·7	1·085	2·151	·051	115	2·41	92·7	4·4
	854	5·0	55·8	1·087	2·130	·055	·175	2·58	90·3	7·4
	845	5·2	66·6	1·085	2·084	·073	·160	3·50	89·9	6·9
	760	8·5	63·5	1 084	2·076	·034	·172	1·63	90·9	7·6
	789	5·0	66·0	1·085	2·056	·062	·199	3·01	88·7	8·5
	829	3·8	61·0	1·081	1·988	·043	·166	2·16	90·4	7·6
	784	6·7	64·2	1·0865	1·983	·104	·349	5·24	84·2	14·4
	773	6·7	69·1	1·082	1·978	·049	·207	2·47	88.5	9·3
	783	4·8	64·8	1·080	1·962	·064	·150	3·26	90·1	6·9
	785	9·3	64·8	1·081	1·962	·113	·122	5·76	89·3	5·5
(selfed)	860	9·7	65·3	1·080	1·952	·071	·153	3·63	89·6	7·0
	36	5·3	66·9	1·086	1·946	·083	·305	4·26	83·4	13 0
	761	10·3	65·7	1·080	1·946	·078	·152	4·01	89 4	6·9
	856	6·3	60·8	1·079	1·931	·039	·188	2·02	89·4	8·7
	777	7·5	64 5	1·0795	1·926	·053	·181	2·75	89·1	8·4
	812	6·8	60·5	1·0805	1·926	·067	·197	3·47	88·0	8·9
	863	4·5	58·8	1·085	1·926	·092	·299	4·77	87·1	12·9
	851	6·7	72·4	1·076	1·915	048	·103	2·51	92·7	5·0
	801	6·3	73·4	1·0795	1·910	·066	·184	3·43	88·4	8·5
145	736	7·3	61·4	1·0845	2·120	·034	·139	1·60	92·4	6·0
	750	5·8	61·1	1·086	2·076	·049	·209	2·36	89·2	8 9

SEEDLING SUGAR CANES FROM SELFED AND UNCONTROLLED PARENTAGE.

(*Continued.*)

Parent (female) Variety.	No. of Seedlings.	Av'ge weight of one cane in po'nds	Expressed Juice. Per Cent. by Mill.	Specific Gravity 17·5/30.	Pounds per Gallon. Sucrose.	Glucose.	Solids not Sugar.	Glucose ratio.	Quotient. Purity	Non-Sugar.
(selfed)	742	8·0	64·7	1·0815	2·030	·041	·144	2·02	91·6	6·5
	732	11·0	66·4	1·087	1·998	·083	·279	4·15	84·6	11·4
	722	7·8	65·2	1·081	1·978	·089	·140	4·55	90·0	6·4
(selfed)	346	8·2	66·5	1·080	1·978	·037	·161	1·87	90·9	7·4
	728	9 3	65·7	1·082	1·962	·033	·239	1·68	89·3	10·7
	748	9·0	64·3	1·0845	1·962	·104	·227	5·81	85·5	9·9
	739	7·2	67·2	1·0815	1·926	·083	·206	4·36	86·9	9·3
	730	9·0	61·3	1·082	1·941	·057	·236	2·93	86·9	10·5
	727	8.5	67·1	1·080	1·915	·051	·210	2·66	88·0	9·7
	747	13·5	64·3	1·080	1·905	·089	·182	4·67	87·5	8 5
(selfed)	335	7·3	64·4	1·083	1·900	·212	·144	11·16	84·3	6·4
44	51	8·4	69 8	1·0885	2·099	·069	·239	3·29	87·2	9·9
	56	9·8	66·6	1·087	2·004	·141	·215	7·03	84·9	8 0
	52	7·9	68·3	1.0885	1·978	·196	·233	9·91	82·2	9·7
	60	10·6	70·6	1·086	1·972	·125	·237	6·34	83·2	10·1
4397	114	9·5	71·8	1·085	2·110	·066	·141	3·48	91·0	6·1
	103	9·3	73·5	1·084	2·056	·075	·151	3·64	90·1	6·6
	102	5·7	67·3	1 083	2·050	·046	·158	2·24	91·4	7·0
	113	7·3	71·0	1·079	1·920	·069	·169	3·60	88·9	7·9
317	157	7·3	68·3	1·088	2·151	·058	·179	2·69	90·8	7·4
	155	6·3	70·3	1·088	2·130	·027	·231	1·27	89·2	9·7
	179	8·3	70·0	1·089	2·084	·109	·223	5·23	86·2	9·2
	174	9·5	63·9	1·082	2·030	·041	·163	2·02	90·8	7·3
	127	11·2	70·0	1·086	1·957	·092	·285	4·70	83·8	12·2
	148	7 5	66·0	1·031	1·920	·061	·216	3·17	87·4	9·8
	175	9·0	60·7	1·080	1·905	·061	·209	3·20	87·5	9·6
	511	11 0	74·1	1·0815	2·009	·045	·161	2·24	90·7	7·2
	405	9 0	66·3	1·085	1·998	·062	257	3 10	86·2	11·9
	503	9·0	71·8	1·081	1·920	·109	·168	5·67	87·4	7·6
	494	7 3	73·1	1·0785	1·905	·113	·117	5·93	89·2	5·5
721	869	7·3	67·2	1·085	2·115	·059	·143	2·79	91·2	6·1
	867	6·5	60·4	1·082	1·978	·073	·183	4·74	88·5	8·2
	886	8·7	71 7	1·079	1·905	·083	·170	4·35	88·2	7·2

Canes of a similar character raised **from hybrid parentage** are shown in the following **table:—**

SEEDLING SUGAR CANES—HYBRID VARIETIES.

Parent Varieties.	No. of Seedling.	Average weight of one cane in pou'ds.	Expressed Juice. Per Cent. by Mill.	Specific Gravity $\frac{30°}{17·5}$	Pounds per gallon. Sucrose.	Pounds per gallon. Glucose.	Pounds per gallon. Solids not Sugar.	Glucose Ratio.	Quotient. Purity	Quotient. Non-Sugar.
118 x 145	209	7·0	68·6	1·085	2·076	·059	·188	2·84	91·9	8·1
	223	5 0	70·0	1·085	2·076	·119	·211	5·74	86·2	8·7
	219	5·5	70 7	1·084	2·014	·100	·168	4·96	88·2	7·4
	193	7·0	71·1	1·089	1·988	·169	·263	8·50	82·1	10·8
	224	8 7	69·1	1·079	1·936	·057	·165	2·94	89·7	3·0
	241	7·5	65·9	1·082	1·915	·071	·248	3·70	85·7	11·1
	220	7·3	69·8	1·079	1·910	·125	·123	6·54	88·6	5·8
	258	7·0	66·7	1·079	1·889	·036	·233	1·90	87·5	10·8
	246	6·0	61·6	1·084	1·884	·100	·298	5·30	82·5	13·6
	215	5·7	68·1	1·081	1 874	·119	·204	6·35	85·7	9·3
	201	6·3	72·6	1·080	1·874	·089	·213	4 80	86·1	9·8
	199	5·8	62·5	1·082	1·863	·109	·262	5·85	83·4	11·2
	194	6·7	66.7	1 081	1·858	·096	·243	5·16	84·9	11·0
	214	7·3	71.8	1·081	1·837	·073	·287	3·97	84·0	13·0
	222	6·7	65·6	1·078	1·822	·158	·141	8·67	85·9	6·6
	212	5·3	63·9	1·085	1·806	·257	·254	14·23	78·0	10 9
	217	6·7	70·9	1·077	1·801	·077	·218	4·27	85·9	10·3
118 x 167	303	6·8	58·6	1·087	2·040	·083	·237	4·07	86·2	10·2
	282	7·3	66·4	1·086	2·009	·104	·221	5·17	86·0	4·4
	289	7·8	63·1	1·080	2·004	·027	·146	1·34	92·1	6·7
	278	6·7	63·4	1·083	1·993	·047	·214	2·36	88·4	9·5
	300	5·8	54·5	1·080	1·900	·034	·242	1·79	87·7	11·1
	299	7·0	54·5	1·083	1·889	·109	·256	6 79	83·8	11·3
	292	9 0	64·7	1.081	1.863	·119	·215	6·29	85·2	9·8
	294	6·0	57·9	1·080	1·863	·080	·233	4·29	85·6	10·7
	304	7·3	62·4	1·081	1·827	·057	·313	3·12	83·7	14·2
	277	8·7	74·1	1·080	1·822	·089	·265	4·88	83·7	12 1
	280	7·3	70·5	1·078	1.816	·058	·257	3·19	85.6	12·1
	276	7·8	64·8	1·084	1·806	·212	·264	11·73	79·1	9·3
118 x 419	182	9·5	70 4	1·090	2·019	.066	·356	3·26	82·7	14·5
	190	5·3	66·9	1·082	1 900	.096	·238	5·05	85 1	10·6
118 x 625	306	7·8	64·9	1·080	1.827	·057	·293	3·12	83·9	13·4

THE RESULTS COMPARED.

57.2 per cent. of the canes of uncontrolled parentage which an account of their cultural characters were selected for analytical examination proved to be of high potential value on account of the characters of their juice, whilst of the

similarly selected hybrid canes 58.3 per cent. had similar characteristics. But only 60 canes of hybrid parentage were obtained suitable for examination, while 430 canes of uncontrolled parentage were selected, hence the value of raising canes from uncontrolled, although selected parentage, proved higher than that of raising hybrid canes.

430 seedlings from uncontrolled parentage included 26 varieties of exceptionally high quality whilst in 60 hybrid varieties 8 were of like character. Here the advantage was with the hybrid seedlings 13.3% of which were of exceptionally high quality as compared with 6 per cent., of those derived from uncontrolled parentage.

The quality of the seedlings examined for the first time in 1915 was far higher than it had been during many previous years.

REDUCED AREA OF BOURBON CANE.

On the sugar plantations of the colony the gradual substitution of the Bourbon cane by new varieties of sugar-cane raised from seed continued. The total area in sugar-cane cultivation is 75,744 acres, an increase of 2,636 acres over the area occupied for the crops of 1915. The following table shows the areas occupied by the principal varieties of canes under cultivation for the crops of 1915-1916:—

PRINCIPAL VARIETIES OF CANES, 1915 AND 1916.

AREAS IN ENGLISH ACRES.

Variety.	*1915. Acres.*	*1916.*		
		Acres	*Increase.*	*Decreases*
D 625	36,922	37,178	256	
Bourbon	10,775	9,109	...	1,686
Bourbon mixed with other varieties	2,713	5,294	2,581	...
D 145	5,916	6,088	172	...
B 208	6,820	6,012	...	808
D 109	1,748	1,725	...	23
Diamond 185	1,791	1,582	...	209
Green Transparent	1,155	1,360	205	...
D 118	547	887	340	...

PRINCIPAL VARIETIES OF CANES, 1915 AND 1916.

AREAS IN ENGLISH ACRES.

(Continued.)

Variety.	*1915, Acres.*	*1916.*		
		Acres.	*Increase.*	*Decrease.*
D 419	213	404	191	...
Java Seedling varieties ...	136	178	42	...
B 147	192	156	...	36
D 115	49	132	83	...
D 167	83	98	15	...
D 116	100	80	...	20
D 4399	105	78	...	27
D 74	73	73	...	...
B 6450	17	64	47	...
Diamond 37	49	60	11	...
B 376	63	62	...	1
D 4397	80	49	...	31
White Transparent	14	21	7	...

DISTRIBUTION OF VARITIES.

The tables indicates the relative distribution of the various kinds of canes as follows:—

	For Crops of 1915.	*For Crops of* 1916.
D 625	50.50	49.08
Bourbon	14.74	12.03
D 145	8.09	8.04
B 208	9.33	7.92
Mixed Bourbon and seedlings principally D 625	3.71	6.98
D 109	2.39	2.28
Diamond 185	2.45	2.09
Green Transparent	1.58	1.79
D 118	.77	1.17
D 419	.29	.53
Other varieties unenumerated	6.15	8.09
	100.00	100.00

From the returns supplied by the sugar-plantations the distribution of the various sugar canes in cultivation for the crops of 1916 according to their origin is as follows:—

Bourbon and other old varieties		17.22
Java		.25
*Barbados		9.20
British Guiana	Plns. Diamond & Providence	2.63
	Botanic Gardens	70.70
		100.00

YIELDS.

The average yields in tons of commercial sugar per acre of the principal varieties under cultivation for the crops of 1915 as deduced from the returns by the Managers of the sugar-plantations were as follows:—

Varieties of Sugar-cane.	*No. of Plantations reporting.*	*Areas in Acres.*	*Tons Sugar per Acre.*
D 167	6	64	2·26
B 3412	2	16	2·25
D 721	2	16	2·24
Green Transparent	8	702	2·03
B 376	4	16	2·01
D 118	9	479	1·98
Diamond 185	5	1,551	1·86
D 419	5	190	1·81
D 625	34	31,027	1·80
B 147	6	153	1·76
B 6450	2	19	1·73
Bourbon	23	6,888	1·68
D 145	24	5,383	1·66
Mixed	13	4,095	1·60
D 4397	6	56	1·59
Diamond 399	3	50	1·57
D 4399	3	71	1·54
B 208	19	5,452	1·52
D 109	13	1,284	1·00
D 4395	2	18	1·46
D 116	3	123	1·16

NOTABLE VARIETIES.

Results of single large trials with varieties which have given yields in excess of the average yield of D 625 are shown in the following table:—

Variety.	*Tons sugar per acre.*
Diamond 37	2.88
D 199	2.35
R P 26	2.25
Black Java	2.20
R P 10	2.20
D 317	2.20
D 95	2.17
Diamond 382	2.17
D 101	2.16
D 325	2.14
B.S.	2.10
D 179	2.10
White Transparent	2.10
D 528	2.05
D 405	2.01
D 651	2.00
R P 1	1.97
R P 5	1.89
D 216	1.86
D 1087	1.86
D 98	1.83
R P 8	1.81
B 1566	1.81
D 181	1.80

The export of sugar for the year 1915 was 116,223 tons, an increase of 9,086 tons over that of 1914. The total export of rum was 4,698,230 proof gallons or 1,209,551 gallons in excess of that of the previous year. No molasses was exported during the year as by far the greater proportion of it was used in the preparation of rum. The export of molascuit was 2,233 tons, or 193 tons less than in 1914.

PESTS AND DISEASES.

The insect pests of the sugar cane are reported on as follows by the Economic Biologist:—

"*Sugar Cane*.—No substantial change in the status of the "insect pests connected with this crop can be recorded. "Control work when carried on along sound principles "continues to give good results but concerted action of a far "more vigorous character will be necessary before any one "pest of sugar cane can be said to be really under control.

"Such matters as the collection of the eggs of the small "Moth Borer, the breeding and distribution of the parasites "of these eggs, and steady and efficient work performed by "the gangs told off for this purpose, require constant and "careful supervision by a careful individual and is a vital "factor towards success.

"Too great a stress cannot be laid on the conscientious "selection of tops for planting. That a top already infested "by borer cannot give a healthy cane or an eventual adequate "yield of sugar is a simple fact; yet it is the rule rather than "the exception to find it absolutely and entirely ignored.

"No new serious pest has made its appearance and the "formidable list of sugar cane pests remain the same."

Fungoid diseases affecting the sugar cane were, speaking generally, not prevalent during the period under review. No new diseases were recorded. *Marasmius sacchari*, the root fugus, continued to cause damage in the county of Berbice; but from reports received it was less prevalent than in either of the two previous years. *Leptosphaeria sacchari* and *Cercospora vaginae*, leaf fungi, were still in evidence but showed no increase over the previous year.

RICE.

The return of the area under rice in the colony was 50,737 acres, an increase of 3,700 acres over that of 1914; but as two crops were taken during the year on the Essequibo coast the total acreage reaped was 55,574. The crop was a good

average one, resulting in 1,051,183 bags of 140 lbs. each equivalent to 20.72 bags per acre or nearly 1 bag per acre more than in the crops of the previous year.

The exports of rice and of rice-meal during 1915 amounted respectively to 9,058 tons and 266 tons.

The experiments with different varieties of rice were continued at the Experimental Fields. As in the previous year varieties of proved value were planted in the North Field on duplicated half-acre plots. The following yields were obtained :—

Selected Varieties.	*Bags of* 140 *lbs. per acre.*
No. 75	30.6
Demerara Creole	30.6
H 6	30.4
Selected Strains.	
No. 75, Strain 7..	30.8
No. 75, Strain 6..	30.6
H 6, Strain 1..	30.5

The crop was below the average of previous years. During the period of eleven years during which trials with these three varieties have lasted the mean results have been as follows :—

Variety.	*Bags of* 140 *lbs. per acre.*	*Creole taken as* 100.
H 6	33.2	103.8
No. 75	32.7	102.2
Demerara Creole ..	32.0	100.0

Whilst the Creole rice in recent years has shown a steady increase in yield, the result of careful seed selection, the variety H 6 has given somewhat lower returns than during earlier trials.

USE OF ARTESIAN WELL WATER.

By special direction of the Governor an experiment has been in progress since September, 1914, on the growth of rice by irrigation with artesian water. The water used is supplied by the artesian well in D'Urban Park and is obtained

from the surface of the gneissose rocks which at a depth of 559 feet there underly the coast-lands. Its temperature is 90.1 Fahr. and it has the following composition:—

Grains per Imperial Gallon at 80 F.

Ferrous carbonate	.03
Calcium carbonate	.50
Magnesium carbonate	.70
Sodium carbonate	.16
Sodium chloride	1.17
Sodium sulphate	.01
Potassium carbonate	1.30
Ammonia	.0014
Silica	1.14
	5.0114

The first crop was planted in September, 1913, and 5 crops were obtained in a little less than 25 months. The yields of padi in bags of 140 lbs. were

1st crop	19	bags
2nd ,,	17.7	,,
3rd ,,	25.0	,,
4th ,,	30.0	,,
5th ,,	19.1	,,
Total ..	110.8	

The padi during the 2nd crop was devastated by birds whilst during the 5th crop it suffered from fungus attacks. The results, however, prove that fairly heavy yields of padi can be obtained by the continuous growth of rice on lands irrigated by artesian water.

FREE DISTRIBUTION OF PADI.

During the year 22 tons of selected seed-padi were distributed, principally to small growers in lots of 30 or 60 lbs. to each. It is estimated that the padi so distributed was sufficient to plant nearly 1,000 acres.

The duplicate and quadruplicate trials of certain varieties and strains in 1-16 acre plots were continued, the Demerara Creole being employed for the comparison of yields. The trials gave the following results:—

Variety or Strain.	*Bags of 140 lbs. per acre.*
Demerara Creole (specially selected) ..	30.1
No. 75, Strain 8	35.9
No. 75, Strain 4	32.8
No. 75, Strain 2	38.5
No. 75, Strain 1	25.7
Demerara Creole (ordinary)	29.9

Three strains gave higher yields than the creole.

ARTIFICIAL HYBRIDISATION.

Experiments on artificial hybridisation were continued during the period under review. The better varieties were planted in "progeny rows" for the purpose of selecting pure strains for crossing. It is hoped with the aid of a special device to reduce the amount of injury to the flower which results from emasculation before the flower opens and in this way to obtain a fair percentage of artificial hybrids. Of a number of flowers which were artificially pollinated about one-fourth set seed. All of these are believed to be true hybrids. This work now shows promise of yielding some conclusive results in regard to the possibility of controlled artifical hybridisation of the rice-plant.

NO BENEFIT FROM NITROGENOUS MANURES.

Manurial experiments were continued in the North Field on the same lines as in previous years and with similar results in regard to the absence of any beneficial effects from the application of a nitrogenous manure. Its application appears only to increase the luxuriance of the vegetative growth, thus causing the plants to be early laid.

GROWTH OF THE RICE INDUSTRY.

From 1903 to 1914 the area under cultivation in rice increased from 17,503 British acres to 47,037. During the year under review the acreage was 50,737 acres, an increase of 3,700 acres on the acreage reported for 1914. 13,600 acres equal to 26.8 per cent. of the area under rice are situated within the empoldered areas of sugar plantations.

The gradual extension of the rice industry is well illustrated in the following table which gives at five-yearly intervals the areas in British acres under rice in the various counties of the colony and the yields of padi and of rice in long tons:—

Period.	Mean Rainfall Coastal Stations Calendar year.	Area under Rice Cultivation, British Acres.				Yields of British Guiana.		
		Berbice.	Demerara.	Essequibo.		British Guiana Total.	Padi Tons.	Equal to Ricetons 60 % yield of cleaned Rice from Padi.
				Mainland.	Islands.			
1898	49·9	4,874	1,592	...	308	6,778	6,374	3,824
1903	99·2	8,684	4,951	3,076	1,001	17,712	17,701	10,620
1908	91 1	16,893	13,862	5,042	3,941	39,746	50,010	33,006
1913	89·6	8,752	19,422	3,936	2,472	35,582	43,170	25,902
1914	73·6	16,491	22,264	4,009	4,273	47,037	66,268	39,760
1915	86.3	18,443	22,122	6,244	3.928	50,737	65,700	39,420

The relation of the rice growing industry to the sugar-cane and other agricultural industries of the colony during the period 1903 to 1915 is summarized in the following table in which the areas occupied by the varied industries are given in British acres:—

	Sugar-Cane.	Rice.	Other Products.	Total areas under cultivation.
1903	78,860	17,503	21,442	117,805
1904	74,424	23,016	28,338	125,778
1905	76,011	25,347	30,940	132,298
1906	78,158	27,898	30,317	136,373
1907	74,441	31,196	27,943	133,580
1908	74,865	39,746	33,356	147,967
1909	73,224	27,540	31,901	132,760
1910	73,319	33,264	36,651	142,139
1911	72,138	37,826	40,487	150,451
1912	71,808	44,020	43,132	158,960
1913	72,698	35,582	43,832	152,072
1914	73,108	47,037	49,389	169,534
1915	75,744	50,737	49,888	176,369

COCONUTS.

The area planted in coconut palms in the colony showed a still further increase whilst a steadily continued extension of the planting of coconuts may be expected. The total acreage under cocoanuts now is 17,920, an increase of 2,026 acres over that of 1914. The development of the industry during five-yearly periods since 1904 is shown in the following:—

Year.				*No. of acres planted.*
1904	..	..	..	.. 5,140
1909	..	..	..	.. 9,466
1914	..	..	..	.. 15,894
1915	..	..	..	.. 17,920

The export of coconuts during the year was 2,090,000, being 200,000 more than in the previous year. As much of the acreage consists of young and immature plants a continued increase in the export of this product may be anticipated during future years. The following table gives the export of coconuts for quinquennial periods since 1892:—

Periods.			*Average Annual Exports.*	
1892- 6	..	..	.. 80,374	nuts.
1897-01	..	..	.. 21,892	„
1902-06	..	..	.. 187,305	„
1907-11	..	..	.. 526,901	„
1912-15 (4 years only)			.. 1,593,235.	„

A small quantity of copra was exported, 1,619 cwt., a little less than in the previous year.

YIELDS OF SELECTED VARIETIES.

The varieties raised at the Botanic Gardens from imported seed and from selected local nuts yielded a crop of 992 nuts. Of these 524 specially selected nuts were distributed for planting purposes. The yields were as follows:—

Singapore plants	..	..	366	nuts.
Tobago „	..	..	186	„
Trinidad „	..	..	62	„
Local „	..	..	378	„

In the recent plantings of coconuts on the large scale more careful attention is being paid to the proper spacing of the

plants, whilst the need for satisfactory drainage is being recognised. On many of the older plantations the palms are planted far too closely whilst the necessity for proper drainage has been in frequent instances more or less completely overlooked. The drains are allowed to become choked with weeds and the beds to be taken over with grass, and little attention is given to the control of insect pests and the avoidance of "bud rot."

INSECT PESTS

The Economic Biologist in his report draws attention to two formidable pests which were active on coconut palms during the year. These were the caterpillar of the butterfly *Brassolis sophorae* which defoliated large areas of palms in the East Coast of Demerara, and swarms of the great locust *Tropidacris latreillei* which defoliated numerous coconut plantations on the Upper Corentyne Coast. Neither of these pests is new to the colony and the means necessary for keeping them under control are well-known but a deplorable lack of interest is shown by many planters of coconuts in dealing with these destructive pests.

RUBBER.

The area returned as being under cultivation in this product is 4,687 acres. This indicates a decrease of 275 acres as compared with the area returned as under rubber for 1914 due to the throwing-out of the areas planted with Sapium rubber as well as to the abandonment of some small areas of Para rubber the soils of which had proved to be unsuited for its cultivation.

GROWTH OF TREES.

The average rates of growth of trees at the various stations of the Department have been as shown in the following table:—

Age of Trees in Years.	Onderneeming	Issorora	Christianburg	Marlborough.	Georgetown.
1	3.0	2.0	2.0	2.0	1.0
2	8.7	4.5	6.2	5.0	3.3
3	12.7	10.0	8.9	9.0	4.0
4	17.7	16.7	10.8	15.0	6.5
5	21.0	21.0	14.4	19.0	8.0
6	22.3	25.0	18.0	22.0	8.5
7	24.0	29.0	21.0	23.0	9.7
8	25.2	30.0	...	...	11.5
9	28.7	...	...	...	...
10	30.0	...	...	...	...
11	33.0	...	...	...	...
12	35.7	...	...	...	...
13	39.0	...	...	...	...
14	44.0	...	...	...	...

YIELDS AND PRICES.

Experimental tapping was continued at Issorora and Onderneeming, and for a portion of the year only at Christianburg.

At Issorora the crop for the 12 months February, 1915 to January, 1916 was 1,000 lbs. of dry rubber (854 lbs. biscuit and 146 lbs. of other grades), this being the produce from 428 trees varying in age from 5 to 7 years, an average of over 2¼ lbs. of dry rubber per tree.

In one experiment 300 trees were tapped by a man and a boy and yielded 873 lbs. of dry rubber which cost $58.40 to collect, or just under 7 cents per lb. Most of the produce was sold in London in February, 1916, and realised a price of 81 cents per lb. for biscuits and 68 cents per lb. for scrap and other lower grades.

The latex of the remaining 128 trees was employed principally for the preparation of "ball" rubber by smoke coagulation in a similar manner to the Brazilian method. Up to the present the product has not been reported on or sold.

At Onderneeming the crop was 310 lbs. of dry rubber (257 lbs biscuit and 53 lbs. scrap and other grades). A portion

of this was sold in February, 1916, for 81 cents for biscuits and 68 cents for scrap.

At Christianburg the tapping of 128 trees was completed. The produce of one year's tapping was 201 lbs. of dry rubber (161 lbs biscuit and 40 lbs. scrap and other grades. A part of the produce was disposed of in September, 1915, for 56 cents per lb. The remainder realised in February, 1916, 81 cents for biscuits and 58 cents for scrap.

The results obtained with the growing and preparation of Para rubber at the Experiment stations were, therefore, highly satisfactory.

The trees at the experimental stations, with the exception of those at Onderneeming, were attacked by a disease affecting the leaf and producing recurrent defoliation of the trees. This disease, which is due to a fungus organism (*Fusicladium macrosporum*, Kuyper) showed a marked increase among the rubber cultivations in the colony. In September, 1915, the Board of Agriculture issued an order declaring the colony to be infected with the disease and prescribing certain methods of treatment with the object of minimising the damage caused by it. This disease is still present on many rubber plantations and efforts are being made to eradicate it.

COFFEE.

The return of the total acreage under this produce was 4,468 acres, an increase of 142 acres over 1914. The gradual extension of the industry continues. As was pointed out in the previous report the planting is being done mainly with the Liberian variety. The lower cost of cultivation and the good returns obtained with this variety have led to greater attention being paid to its cultivation than to that of the Arabian variety. The gradual extension of the area under cultivation with coffee during recent years is indicated by the following table:—

Year.	*Area under Coffee.*
1905	1,432 acres.
1910	2,516 ,,
1915	4,468 ,,

The export of coffee was 1,538 cwt., 593 cwt. less than that of 1914, due solely to the meteorological conditions during the year. Most of the coffee grown in the colony is consumed locally; the total export is only a portion of the crop which is gathered.

CACAO.

The area reported as being under cacao showed a decrease of 434 acres as compared with that of 1914. It is, however, exceedingly doubtful if a decrease to this extent has taken place. Cultivators at times return their areas of young caco as "cacao" and at others as being "under ground provisions." The area now is similar in extent to that returned for 1913. Unfortunately the industry remains in much the same condition as in previous years. In some parts of the colony cacao-planting is an industry of promise but it requires for its successful installation more capital than small farmers can command.

EXPORTS OF CACAO.

The export of cacao during the year was 532 cwt. or 57 cwt. more than in 1914. The lack of extension or rather the stagnation of the cacao-growing industry is illustrated by the following table:—

Year.	*Areas under Cacao.*
1905	1,994 acres.
1910•	2,016 „
1915	2,020 „

MANURIAL EXPERIMENTS.

In the report for 1914 the results of trials with artificial manures, containing nitrogen, potash and phosphates, and the effects of mulching and removal of shade at Onderneeming were given. A fresh series of trials was commenced in 1915 for the purpose of ascertaining the effects of:

(1) Mulching 1915-1918.
(2) Mulching (cumulative results) 1909-1918.
(3) Mulching (residual 1909-1912.)
(4) Phosphoric acid with and without mulching.
(5) Potash with and without mulching.

The second series of experiments at Onderneeming were completed during the year, the object being to asertain the residual effects of the manures applied during the years 1910, 1911, and 1912. For this purpose the plots were not manured in either 1913, 1914 or 1915. The results in terms of wet and of cured cacao per acre were:—

Treatment, 1910-1912.	Yields, 1915. Pounds per acre. Wet cacao.	Cured cacao.
No manure —	1938 ± 100	709 ± 11
Heavy mulching	1950 ± 100	714 ± 36
Sulphate of Ammonia	1648 ± 5	603 ± 2
Superphosphate and Sulphate of Potash	2037 ± 163	745 ± 59
Sulphate of Ammonia and Superphosphate	1770 ± 41	648 ± 15
Sulphate of Ammonia and Sulphate of Potash	1638 ± 190	599 ± 69
Sulphate of Ammonia, Superphosphate, and Sulphate of Potash	2025 ± 134	741 ± 16

The results in terms of lbs. of cured cacao per acre during the three years of non-application of manure—the residual effects from the former applications—have been as follows:

No manure	1704	±	46
Heavy mulching	2052	±	99
Sulphate of ammonia	1681	±	54
Superphosphate and sulphate of potash ...	2197	±	176
Sulphate of ammonia and superphosphate ...	1817	±	93
Sulphate of ammonia and sulphate of potash ...	1653	±	174
Sulphate of ammonia, superphosphate and sulphate of potash	2035	±	124

Allowing due weight to the probable errors of the trials the results indicate that only the heavy mulching treatment and the application of superphosphate of lime and sulphate of potash exerted beneficial residual effects which were of the order:—

	Cured cacao; increase on not-manured plots lbs. per acre.	*Per cent.*
Heavily mulched ..	.. 72 ..	21.8
Superphosphate and sulphate of potash	.. 51 ..	18.1

During the third year the effects of the earlier treatment were *nil*.

The total yields of the plots during the six crops of the second series (1909-1915) of trials were:—

	Pounds per Acre.	
	Wet Cacao.	*Cured Cacao.*
No manure	8,890 ± 226	3,253 ± 82
Heavy mulching	10,818 ± 286	3,960 ± 105
Sulphate of ammonia	8,280 ± 308	3,030 ± 113
Superphosphate and sulphate of potash .	10,915 ± 460	3,995 ± 168
Sulphate of ammonia and superphosphate ..	8,499 ± 407	3,477 ± 149
Sulphate of ammonia and sulphate of potash ...	8,977 ± 600	3,280 ± 220
Sulp. of ammonia, superphosphate and sulp. of potash	10,154 ± 355	3,720 ± 130

The indicated maximum and minimum gains per cent. of dry cacao on the not-matured plots as deduced from consideration of the probable errors are:—

Yields of not-matured Plots for purpose of comparison.	PER CENT. *Minimum gains on 3,335 lbs.*	*Maximum gains on 3,170 lbs.*
Heavily mulched plots. Probable increase due to treatment .	15·6	28·4
Plots dressed with sulphate of ammonia	nil	nil
Superphosphate and sulphate of potash	14·8	31·3
Sulphate of ammonia and superphosphate	nil	nil
Sulphate of ammonia and sulphate of potash	nil	nil
Sulphate of ammonia, superphosphate and sulphate of potash	7·6	21.4

INTERPRETATION OF RESULTS.

It is evident that the soil contains a supply of available nitrogen sufficient for the requirements of cacao under the climatic and meteorological conditions existent at Onderneeming; that the readily available phosphates and potash present in it are not sufficient for the requirements of the cacao; that of these it is probably the phosphates which are deficient, but to enable phosphatic applications to exert their effects some addition of readily available potash is requisite. Applications of lime to the land have been without any beneficial action on the producing powers of the cacao trees.

The sole objection to the use of heavy mulchings is the expense, four years' mulchings costing $66 per acre. The value of the excess of cacao at the price of 12½ cents per lb. of cured cacao obtained during seven years if taken at the lowest indicated return—520 lbs.—is $1.00 less than the cost of the mulching; whilst at the highest indicated rate of increase—894 lbs.— it is in round figures $46 in excess of the cost of mulching.

The total cost of the four manurings with phosphates and potash was $16 per acre. The lowest indicated excess yield during seven years was 472 lbs., the maximum 992 lbs. The minimum shows a profit from their application of $43, the maximum one of $107. The chance of obtaining enhanced yields by the combination of mulching with manurings of phosphates and potash is a good one and hence future trials will be principally directed towards examining into its feasibility.

YIELDS.

The average annual yield of cured cacao at Onderneeming from 1900 to 1913 and the yields during 1914 and 1915 were as follows:—

	Cured cacao. lbs. per acre.
1900-1908	1,064
1909-1913	5,004
1914	4,548
1915	6,635
Mean annual yield, 1909-1915 ..	5,130 lbs.

The mean annual increase of 4,066 of cured cacao has been due to the three factors of lessening the shade, adequate tillage and care of the cacao trees, and improved drainage.

EFFECT OF SHADE.

During the period 1913-1915 the returns from the heavily shaded and the lightly shaded areas have been at the following rates:—

	Heavily Shaded.		Very Lightly Shaded.	
	No. of Pods.	*Lbs. of cured Cacao.*	*No. of Pods.*	*Lbs. of cured Cacao.*
1913	5,889	442	9,546	667
1914	3,950	273	8,870	557
1915	4.860	341	8,550	562
Means	4,810	352	8,990	595

In round figures the annual increase due to lessening the shade has been $2\frac{1}{4}$ cwt. per acre. During the last three crops the increased yields of cacao at Onderneeming have been in round figures at the rate of 4 cwts. per acre of 300 trees. Of this increase $2\frac{1}{4}$ cwt. have been due to lessening the shade and $1\frac{3}{4}$ cwt. to other improvements.

CONDITIONS FOR SUCCESSFUL GROWTH.

The experiments which have now been carried on for a period of 15 years indicate that in British Guiana under conditions similar to those existent at Onderneeming farm the methods of cultivation precedent to the successful growth of cacao are:—

(1.) The reduction of "shade" to the lowest amount compatible with due protection from wind.

(2.) Deep and efficient drainage, certainly not less than from 3 to 4 feet.

(3.) Annually forking the land between the trees in such a manner as not to injure their roots more than is absolutely unavoidable, whilst effectually loosening the soil for aeration

and drainage and thus constantly adding to the depth of tilled surface soil and the feeding area available for the roots of the trees. To do this requires the services of skilled forkers working under strict supervision.

(4) Mulching the soil, but only so far as can be done at low expense, such expense not exceeding $6 per acre.

(5.) Manuring the trees with a mixture of superphosphate of lime and sulphate of potash. The cost of such application should not exceed $4 per acre.

LIMES.

The total area returned as planted in lime trees in the colony during 1915 was 972 acres, an increase of 283 acres over that of 1915. This acreage is mainly in the hands of two companies,—Messrs. Davson & Co. of Pln. Providence, Berbice, and the Agatash Estates, Essequebo River.

The export of citrate of lime was 170 cwt., or 71 cwt. more than in 1914.

It is now fully proved that lime trees grow well on the lighter lands of the colony wherever they are protected from the force of the wind. When it becomes more generally known that there are very large areas of loose, friable land in the colony well adapted to this cultivation a rapid extension of the lime-growing industry should take place.

Locusts as Manure.

A. E. Collens, in Bull. Dept. Agri., Trinidad and Tobago (1915, 14, 6), calls attention to the fact that locusts form a valuable nitrogenous manure, and when they can be collected in quantity should be applied to the land. Air-dried specimens of *Tropidacris dux*, a large locust found in the Cedros district of Trinidad, contained 9.98 per cent. of nitrogen, 0.94 per cent. of potash, and 1.44 per cent. of phosphoric acid. Venezuelan locusts (*Schistocerca paranensis*) in an air-dried condition contained 10.99 per cent. of nitrogen, 0.85 per cent. of potash, and 1.30 per cent. of phosphoric acid.

—"Bulletin of the Imperial Institute," April-June, 1916.

The Making of Panama Hats.

A SUITABLE INDUSTRY FOR BRITISH GUIANA.

By C. K. Bancroft, M.A., F.L.S., Assistant Director, Department of Science and Agriculture.

The following is an extract from a report by the Director of Science and Agriculture and the Agricultural Superintendent on a visit to the hat-making school at Paramaribo, Surinam, in 1914:—"We were taken to this school by the Director of Agriculture and kindly shown over it by the Inspector of Prisons and the Lady Superintendent. This school, we were informed, was started about 8 months ago and is carried on by a local Committee ; in the beginning, however, it was under the direction of a qualified lady Superintendent from Curacao. This Superintendent has since returned to Curacao and the school is at present being superintended by another lady and by the Inspector of Prisons. The pupils of the school are girls and young women and the number of them we were told was 60; but at the time of our visit there were only about 20 in attendance, and they were engaged in plaiting hats. This school has not yet received a Government subsidy. The fee payable by each pupil is 2½ guilders or $1.00 per month. The method of preparing the leaves of the Carludovica was explained to us, and briefly it is as follows : the young and undeveloped leaves are cut with about 6 inches of the leaf stalk attached : a sharp thin knife is then used for removing the larger veins of the leaf and if this is done skilfully, the intermediary parts of the lamina alone are left attached to the upper portion of the stalk. The short stalk is then held in the hand and given a sharp switch, similar to the cracking of a whip, in order to see that all the intermediary parts are quite free from each other. After this, the leaves are put into boiling water and kept boiling for, say 10 to 15 minutes. Care must be taken to see that the vessel in which the leaves are placed is not one of iron as iron is said to stain them. After they are taken out of the boiling water they are put out in the sun for 2 or 3 hours to dry, and then bleached in a sulphur chamber for a day.

We were informed that it takes 6 leaves to make an ordinary sized hat and that a coarse hat can be made in one day while a finely made one would take about 18 days. After the hats are made they may be hung in an airtight box and subjected to sulphur fumes which will bleach them to a beautiful white. We were also shown straw from the Æta palm (*Mauritia flexuosa*) from which hats were going to be made. This palm, it may be stated, grows plentifully in swampy parts of this Colony. We were especially interested in this school and formed the opinion that if a school, similar to it, can be started in this colony and made to pay, something will have been done towards solving the growing local problem of finding suitable employment for poor respectable girls and young women. There should be no difficulty in cultivating Carludovicas, as they grow luxuriantly in the North West District of the colony and even on fairly heavy clay land such as occurs at or near to the coastland; and we are of opinion that they will also grow successfully in the Pomeroon, on lands in the Canals Polder on the West Bank, Demerara River, and on the light pegassy lands aback of our villages and plantations. The subject of a local hat-making school similar to the Paramaribo school on experimental trial is one which we venture to think is worthy of consideration."

THE "HAT PALM."

The plant, *Carludovica palmata*, from which the Panama hats are made is a stemless palm, a native of the North-western portion of South America. It is common in shady places all over Panama and on the coasts of Ecuador and New Granada. Its leaves are shaped like a fan, and when mature are six to fourteen feet high. Another species, *Carludovica jamaicensis*, said to be native of the West Indies, is most probably identical with the former, there being no apparent botanical difference between the two. The Jippi-Jappa palm is of the same species, but is regarded by some as a different variety. Plants of the palm have been growing at the Botanic Gardens for many years and have also done well in the North West District at the Government Experiment Station. A fairly light soil is preferable and the plants are best grown under moderate shade. They

can be propagated from seed, but are more readily grown from suckers, the full-grown plants giving rise to numerous suckers and producing large clumps. The period required for a plant grown from seed to produce leaves suitable for hat-making has been recorded at the Botanic Gardens as 15-18 months. By planting suckers only about half of this time is required to obtain a suitable leaf.

FIRST QUALITY HATS.

The principal industry at the present time is in Curacao. Two schools have now been in operation for a few years in Surinam, and recently a start has been made in this colony. The process of preparation of the material is a simple one as described above. A suitable bleaching chamber is made in the form of a box with sliding top, 5 x 8 x 3 ft., at the bottom of which is a coal pot and in the centre a receptacle to contain the sulphur. The sulphur is allowed to fall on to the fire, the quantity being regulated by means of a shutter. The straw is suspended vertically around the sides of the box by means of racks. The process of preparation thus completed, the straw is ready for plaiting. For making hats of first quality the finer veins on either side of the straw are removed by means of a needle or better by the thumb-nail. The plaiting is a somewhat difficult process and requires careful training. It is reckoned that six months' training is required to render a girl proficient in the art of plaiting. A first quality hat takes from three weeks to a month to make, working only four hours a day. Such a hat would fetch locally twelve dollars or more.

Hats are also made of other materials. Rough hats made from strips of bamboo would sell locally for $1.00 Similar hats made from the Awarra and Æta palms are worth $1.20 each. Fine straw made from the leaves of the Æta palm yields a hat which is light and of high quality. It is pale brown in colour and obtains a price equal to that of the best Panama hat.

The Leaf Disease of Rubber.

CONDITIONS IN SURINAM.

By C. K. Bancroft, M.A., F.L.S., Assistant Director, Department of Science & Agriculture, and Government Botanist.

I visited Surinam in December, 1916, for the purpose of examining the *Hevea* cultivations and of conferring with Dr. Stahel, Government Botanist, Department of Agriculture, Surinam, as to the most suitable means of controlling the disease. In all I inspected nine plantations on which *Hevea* was being grown, viz., Voorburg, Sorgvliet, Gejiersvligt, Morgenstond, Clevia, Slootwijk, Wederzorg, Mon Souci and Maasstroom. I also visited the Botanic Station, Paramaribo, on three occasions and examined the work which had been done on the leaf disease. On several occasions I conferred with Dr. Stahel, who accompanied me to five of the cultivations. In addition I examined several cultivations of coffee and cacao.

CLIMATIC CONDITIONS.

The climatic conditions which prevail in the different areas on which rubber is grown in Dutch Guiana resemble closely those of the near interior of British Guiana. In Dutch Guiana, however there is no rubber growing in the immediate vicinity of the coastland as is in this colony. The soil employed for the cultivation of *Hevea* in Surinam is for the most part of high fertility. It is of clay formation, low-lying, and requires to be empoldered for cultivation. In some few instances *Hevea* trees have been planted on heavy clay lands. According to Drost the planting material employed for the *Hevea* cultivation of Surinam was derived mainly from Ceylon from whence seeds were imported and in some cases stumps, the former being considered preferable to the latter. With the exception of those *Hevea* trees which were planted before the extension of the banana cultivation, all of the trees were interplanted in the banana fields with the object of utilising the bananas for shade when the trees were young and removing them at the end of two years. The bananas were replaced in many instances

by coffee and thus a large proportion of the present cultivations are of *Hevea* and coffee interplanted with each other. Owing to the absence of efficient drainage in some instances and also to lack of care in cultivation many of the first planted *Hevea* trees were grown under unfavourable circumstances. These have not attained the girth which they should have. Two or three-year-old trees were reported in 1911 to possess an average girth of 7 to 10 inches measured at three feet from the ground. Five-year-old *Heveas* measured in some instances 13 inches, and in others 19 inches. Measurements of eight-year-old trees averaged 28 to 30 inches. Generally speaking, six years is required for the trees to attain a size suitable for tapping operations to commence. The trees have, therefore, not grown so well as on suitable land in British Guiana. The area planted in *Hevea* in Dutch Guiana is about 2,400 acres. *Cultivations of pure* Hevea rarely occur except at Voorburg, Slootwijk and Vrede. On the first estate about 150 acres are said to be under *Hevea* only. The second possesses 112 acres of pure *Hevea* cultivation and the third about 200. The labour force consists principally of indentured immigrants from the East, Javanese and East Indians. There is comparatively little free labour which is *regarded* as unreliable and costly.

LOW COST OF CULTIVATION.

The cost of the actual operations of cultivation is, generally speaking, lower than in British Guiana, such operations as forking, weeding and drainage being carried out at an appreciably lower cost. But the buildings are more elaborate than in British Guiana, and these, along with the cost of recruiting and incidental expenses such as taxes, medical attendance, &c., render the cost of establishing a cultivation of Hevea, cacao or coffee in Surinam much the same as it is in British Guiana The conditions under which *Hevea* is being grown in Dutch and in British Guiana differ in two main respects. While in British Guiana a fair proportion of the *Hevea* trees are situated in the immediate vicinity of the coastlands, in Dutch Guiana there are no actual cultivations on the coast, except a small area at Nickerie. The greater part of the cultivated *Hevea* in Dutch Guiana is interplanted with coffee, while in British Guiana the large cultivations consist of *Hevea* only.

THE LEAF DISEASE.

The leaf disease of *Hevea* was first noticed in Dutch Guiana at about the same time as it was at first observed in British Guiana, *viz.*, in 1907. It was sporadic in appearance and early investigators did not regard it as likely to become epidemic. It appeared in epidemic form on certain plantations in 1914, affecting principally the younger trees. Subsequently, it spread to other plantations, and it is now present on every estate on which *Hevea* is grown. On the majority of estates the trees are badly affected and are dying in large numbers, some estates having already lost in certain areas one-third of the total number of trees. Trees of all ages are affected, and there appears to be no sign of the disease diminishing in any respect. Tapping operations have for the most part been suspended owing to the great reduction in yield of latex. In British Guiana a fair proportion of the cultivated *Hevea, viz.*, that in the immediate vicinity of the coastland is only slightly affected. Certain other plantations on which the disease was prevalent are reported to have recently shown signs of its diminishing: *viz.*, Providence, Creeklands, Hills Plantation and Vreed-Styn. On other plantations, notably those in the North-West District of the colony, there is at the present time little or no sign of a reduction of the disease. While in Surinam the disease is so widespread and exists in such a virulent form as to lead to the assumption that unless some means is soon found for its control the cultivation of *Hevea* in that colony will soon prove unremunerative, in British Guiana the condition does not yet justify this assumption. But it is not possible at the present time to say whether the disease will or will not assume such proportions in British Guiana as it has in Dutch Guiana.

DISEASE CAUSED BY FUSICLADIUM MACROSPORUM, KUYPER.

The causative organism was examined and named by Dr. Kuyper in Surinam in 1912. It has been studied in great detail by Dr. Stahel since 1914. It has also been investigated in British Guiana by me. The result of these investigations has been that the life of the organism is known in detail, as is also the origin of the disease in *Hevea* plantations and the pathological effect on the host plant. A further study of the organism is likely to prove of little

or no value. The scientific investigations in Surinam and in this colony will be published in detail at some future date. It will suffice for the subject of this report if the general effect of the disease is traced and the more important points are dealt with, without giving an account of the means by which the conclusions have been arrived at. The disease is of fungus origin. It is caused by an organism which has been named from Surinam *Fusicladium macrosporum*, (Kuyper), from British Guiana *Passalora heveae* (Massee), and more recently from Surinam *Melanopsammopsis heveae* (Stahel). The fungus is a native of Peru, Brazil, Dutch Guiana, British Guiana, and probably also Trinidad. It is known to occur in the forests of these countries on wild trees of *Hevea*, *viz.*, on *Hevea brazilienisis*, *Hevea guyanensis* and *Hevea confusa*. No other host is known and it is very unlikely that a host plant other than a species of *Hevea* exists, since the fungus is a highly specialised parasite, being comparable in this respect to a group which comprises the so-called "rust-fungi" (*Uredineae*.) In the forest the disease affects a large number of trees. It is common in the Acre district (Amazon) where the best *Hevea brasiliensis* occurs; it is present on *Hevea guyanensis* in Dutch Guiana from the coast to the far interior of the colony; it has also been found to be present on *Hevea confusa* in British Guiana in the interior of the colony. The disease is propagated by small bodies (spores) which function as seeds, and by this agency it has spread from the wild forest trees to the cultivated *Hevea*.

LIFE-HISTORY OF THE FUNGUS.

On plantations in the East, where the wild *Hevea* is not native, the disease does not occur. It is of interest here to record that three diseases which have done great damage to cultivated crops in the tropics within the past forty years are known to have been caused by organisms present on wild species of the same genus as the cultivated plant and native of the forest only of those countries in which the diseases have occurred. The "witch-broom" disease of cacao occurs on the wild *Theobroma speciosum* in Guiana and is absent from Eastern cultivations, the leaf disease of coffee in the East occurs on native species there and is absent from cultivations in the West, and the leaf disease of *Hevea* in the West occurs on native *Heveas* in South America and is

absent from Eastern plantations. A similar instance of the spread of a forest disease to a cultivation may be seen in the case of a small cultivation of the Mora tree (*Dimorphandra Mora*) at Sectie O in Surinam. This cultivation was established only a few years ago and is already badly affected with a fungus (*Dothidella*) which is present on wild Mora trees in the forest. The risk of disease affecting a cultivation in the tropics is increased if the species is a native of the country in which it is being cultivated.

Three kinds of spores of the fungus are known, *viz.*, conidia, pycnidia, and ascospores. The life-history is therefore complete. The conidia are first produced and occur on all of the parts affected. The pycnidia arise next and have hitherto only been found on the leaves. The ascospores are the last to be formed and like the pycnidia occur on the leaves only. A study of the disease has shown that the conidia are the agency by which rapid spread takes place. They germinate within a few hours and are capable of infecting directly young leaves, young green shoots, leaf-stalks, inflorescences and young fruits. The conidia are distributed principally by the wind. They are short-lived. The pycnidia are of the nature of spermatia and probably take little if any part in the propagation of the disease. The ascospores constitute the highest stage of the fungus and complete its life-history. They may germinate soon after they are produced or may possibly require a period of rest. When the fungus is producing pycnidia and ascospores the disease is not so infectious as when there is an abundance of conidia. The germination of both conidia and ascospores on the plant gives rise to conidia first. The conidia and ascospores, therefore, form the agency of spread, the former being the principal agent.

COURSE OF THE DISEASE.

When the disease commences on a plantation the trees affected are usually scattered here and there. The leaves and leaf-stalks show the presence of the superficial black stromata of the fungus. Holes produced by the falling away of the affected tissues appear in the leaves. Here and there the tips of the young shoots are bare of leaves. The disease then increases in virulence owing to the production of a large number of conidia, each of which may give rise to infection,

and the young leaves then become infected more frequently. This leads to defoliation of the shoots, the trees becoming in some cases entirely bare of leaves. A new crop of leaves is produced, usually within four to five weeks after defoliation. These also are infected and fall. The same process is repeated. The conidia may then exist in such numbers on the plantation that few leaves escape infection before they are more than three weeks old. The concentration of conidiospores, therefore, is a primary factor in determining the virulence of the disease. For the production of each crop of leaves the supply of food reserve in the tree is drawn upon. The tree becomes weaker as the food reserve diminishes. The reduction of the concentration of starch in the wood of the stem consequent on repeated defoliation can be easily observed. The upper parts of the tree are depleted of food and die. The tree is then rendered susceptible to attack by "wound-fungi" of which the principal is the die-back fungus, *Diplodia*. This fungus on entering through dead branches causes the dying back and ultimately the death of the whole tree. Such is the progress of the disease. Trees here and there escape continual defoliation; their leaves although infected are able to develop to maturity. Such trees can obtain some food by means of their leaves and so temporarily survive. It has been suggested that some trees may acquire immunity from the disease, but observation shows that this is doubtful. Dr. Stahel concurs in all of the above except the action of the *Diplodia* or "die-back," to which he does not attach much importance. While I am willing to accept that if defoliation goes on continuously the tree must ultimately die, without the intervention of another organism, yet I consider that the "die-back" fungus not only hastens the death of many trees but that it operates in many cases in which the defoliation alone would not be sufficient to cause death. In the above it is clear that in a given area the amount and effect of the disease depends on the concentration of the spores, principally the conidia of the fungus in that area.

REMEDIAL MEASURES.

In view of the above, remedial measures should be so directed as to reduce the concentration of the spores of the fungus in the area in which the disease occurs, to prevent their germination after they are formed and to prevent the

entrance through dead branches of other organisms into the tree which are likely to assist in bringing about its death. The reduction of the concentration of the spores can only be brought about by the destruction of the living substrata on which they are being produced, in other words by eliminating the sources from which they arise. These sources are the wild Heveas growing in the forest and also the infected leaves of the *Hevea* trees on the plantations. The destruction of wild Heveas in the forest is not easy and would entail an enormous expenditure, both in locating the trees and in felling them. Further, the spores of the fungus can be carried for long distances by the wind. Assuming that the conidia lose their power of germination within twenty-four hours, they can still traverse more than 100 miles within that time and be capable of germinating when they reach their destination. Trees at Arakaka, North West District, which are supposed to be situated fifty miles from any other known *Hevea* trees have become infected. For these reasons I am unwilling to recommend a campaign of destruction of native Heveas in the forest as a preventive measure, but cultivators would assist in reducing infection by destroying all wild Heveas in the vicinity of their plantations. On the other hand, the destruction of infected leaves on the trees on a plantation, if it can be effectively and cheaply carried out, is a measure which is likely to succeed as a control where plantations are badly affected. Owing to the advent of fresh spores from the forest this would have to be repeated more than once at long intervals. If it is to be effective, destruction of the *Hevea* leaves must be carried out rapidly; the whole plantation must be dealt with in less than five weeks, the time allowed for new leaves to be produced.

"SMOKING" AS A TREATMENT.

A method which has been suggested for use in Surinam for the removal of the leaves and young shoots is not practicable, as it would entail a large cost and further, it would not be possible to carry it out with the labour at present available on the plantations. A practical means of destroying the leaves which is likely to succeed where a plantation is bady affected is by smoking; for this purpose some form of smoking must be devised which will cause defoliation rapidly *without injury to the young shoots of the trees,*

would prevent Dutch Guiana from competing with the Dutch East Indies in rubber production. On the other hand he considered that the cultivation of Liberian coffee was likely to prove of considerable value in Dutch Guiana. Liberian coffee is growing exceptionally well in Surinam where it has been planted under suitable conditions. The product is of high quality as the result of careful artificial drying and machining. Cultivators are obtaining a high price for coffee in Amsterdam at the present time, one guilder and ten cents a pound being a price recently obtained. Hence there is a desire to extend the coffee cultivation as much as possible. Whether the market price of Liberian coffee after the war is over will be maintained at the same level as it was some years previous to the war or will sink to the level of ten or more years ago, which rendered the cultivation almost unprofitable, is a matter for speculation only.

COFFEE V. HEVEA.

If the coffee is to be retained the *Hevea* trees must be removed from those areas which contain mixed *Hevea* and coffee. In view of the prevalence of the leaf disease of *Hevea*, the low price of plantation Para Rubber and the high price of coffee, many have decided to remove the *Hevea*. The policy is a sound one under the existing circumstances. Liberian coffee has not in Surinam contracted any disease which is likely to prove serious, and further it is not likely to be affected by a fungus disease which is endemic in the colony. In British Guiana where pure cultivations of *Hevea* occur of 500-600 acres, the situation is different. There is no other crop to fall back upon. The abandonment of the *Hevea* will therefore mean the abandonment of the whole estate or the planting of a new permanent crop.

EPIDEMICS.

Epidemics of a disease in a district are commonly caused by organisms which are present in that district and which on the advent of favourable conditions, principally climatic, coupled with the presence of the host plant in large numbers, give rise to disease of considerable magnitude. Such epidemics usually last for a period of a few years during which they attain a maximum and then commence to wane.

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Whether the present leaf disease ... not it is not possible to say, but there are indications in British Guiana of the disease diminishing on more than one plantation on which it was present in appreciable quantity. An epidemic having spent itself is liable to recur at some future time, which time is determined by the advent of favourable climatic conditions. The condition which usually most influences the spread of fungus disease is the relative humidity of the atmosphere. So long as there are infected wild *Hevea* trees in the forests an epidemic of the leaf disease is always likely to occur; and cultivators of *Hevea* in British Guiana must always be prepared for this emergency.

The Punishment of Science.

Nothing is more valuable to the State than long-continued work in out-of-the-way tracts of nature, but nothing is more injurious to the individual who undertakes it. He is often obliged to devote years of his life to labours which, even if they succeed, bring him no profit whatever, while he is thus losing time which might be spent much more profitably for himself. It is indeed this fact which demonstrates how very inefficient British methods for encouraging science really are—since the State makes no effort whatever to find a remedy for this principal evil. What are we to think of the following case? One of the most meritorious of such workers in Britain—a man who has been toiling for years in a tract which will yield no profit to himself though much profit to science in general—recently sent us a valuable paper. We noticed that his name was not followed by the usual letters, and wrote to inquire why. His answer was that he could not afford to subscribe to the learned societies, the membership of which was denoted by those letters! Can anything more shameful be imagined? In most civilised countries the State, recognising the value of learned societies, gives them such endowment as frees them from demanding subscriptions from their members; and indeed in some States members of academies are actually paid—and rightly so, because men of exceptional learning are or should be of value to the whole nation.

—"Science Progress," April, 1916.

Correspondence.

THE BEST BEANS IN THE COLONY.

THE EDITOR, "Journal of the Board of Agriculture."

Sir,—I have during the past six months been growing the two kinds of beans of which I have previously written in the "Journal," and mentioned as the best two beans ever grown in the colony, *viz.*, the "Park Runner" and "Vilmorin's Stringless" Bonavists.

I am still of the opinion that they are superior to all others, and am more than satisfied as to their suitability for general cultivation.

"Pour encourager les autres," I wish to give an account of what I have done with these, to shew that there is no need for special attention in their cultivation. I have purposely refrained from doing anything more than one would find done in an ordinary labourer's plot, where both space and cash are limited.

The space I have occupied has been less than five roods in length, and only two feet wide. The soil was forked and a little manure added. The seeds were sown and when they began to grow a few sticks were placed for them to climb on; beyond this, and one forking, and watering when there was no rain falling, absolutely nothing else has been done to them, and yet these have supplied my wife and myself with two and three dishes per week. Frequently two and three dishes and more have been picked on the same day; what we did not need for ourselves was sent to friends in town, all of whom declare that they have never eaten such delicate beans before.

These two beans should be widely distributed, because they are so easily grown and are most prolific; there is no reason why they should not be found in every garden in the colony, large or small.

JNO. F. WABY.

4th January, 1917.

Hints, Scientific and Practical.

The Progress of Organic Chemistry. ALTHOUGH this new field of science can point to an unbroken record of progress from its very beginning, although it has enriched the realm of human knowledge with many and important discoveries, it has nevertheless been the scene of most persistent strife, often carried on with an acrimony and bitterness that shocks our modern sense of professional courtesy. Its triumphs have called for sacrifices of human lives and broken hearts, but the obstinacy of past conflicts has taught us to respect the views of others, and to seek for a verification of our own, not in dogmatic discussion, but in careful and logical experimentation, painstaking in the minutest detail, each part a building stone from which the final edifice is to be constructed. Following each other in rapid succession, there arose theory after theory, each having for its aim the explanation of the structure of the organic bodies so far as known; each strong in that it was founded upon some experimental facts; each weak in that it could not embrace in one view the whole of the field it sought to cover; each in turn to be overthrown, but each leaving its germ of truth to be utilized by its successors. First, greatest, and most obstinately maintained, the dualistic theory of Berzelius, finally giving way to the substitution doctrine of Gerhardt and Laurent: then the radicle theory of Liebig and Wöhler, subequently to be transformed and absorbed by the theory of types—all views finally brought into contact at once, so that Laurent, in an attempt to clear up the resulting chaos, sarcastically, and yet rather sadly, calls attention to the fact that for such a simple substance as acetic acid, as many as eleven different structural formulæ were at one time proposed! Indeed, this confusion was inevitable so long as at the same time an equal confusion reigned in a kindred topic of the science—the determination of atomic weights. Not until Cannizzaro, by his masterly revival of Avogadro's hypothesis, taught chemists to use a consistent and logical method of determining atomic weights; not then, until investigators were able to know how many atoms are included in each molecule, were they able to determine properly the relative positions which those atoms bear to each other in any given chemical compound. From

matter upon the surface of the charcoal or sand. This the remnants of the past conflicts much has been taken. The dualistic theory of Berzelius we still find, shorn of its dogma and its inflexibility, in a newer and more reasonable view of the influence of positive and negative constituents on the character of chemical compounds; Liebig's and Wöhler's conception of compound radicles, however greatly modified, is still a part of modern chemistry; the substitution of Dumas are.as true to-day as they were fifty years ago—all, however, under the unifying influence of Cannizzaro's revival, are brought into one great stream by Williamson's and Kekulé's theory of valence and of structural chemistry. It is this advance that has made the great strides of recent years possible; it is this that has produced artificial indigo and caffein, cleared up the dark mystery of the sugar group, given us a concise and clear understanding of the derivatives of benzene and of the terpenes, made possible the development of the aniline and azo-dye industries, enriched medicine with antipyrine, phenacetine, antifebrine, and in countless ways has contributed both to the health and the happiness of mankind. To-day we can scarcely imagine ourselves without these adjuncts of modern civilisation, but if we do picture to ourselves what the world would be were we deprived of them, we must give all credit to the master minds that made these things possible. Truly, in no other field of human progress can it be said with equal truth that the investigations of scientific men, working for the cause of science alone and without thought of pecuniary gain, must inevitably have preceded the commercial application of their discoveries for out of the chaos of the past have sprung the industries of the present.

—"The Spirit of Organic Chemistry" by
ARTHUR LACHMAN.

Adsorption. THE operation of removing the colouring matter from solutions by shaking them with finely ground charcoal or by filtration through sand or other material which exposes a large surface is a familiar one both in the laboratory and on the manufacturing scale. The gradual diminution in efficiency, due to clogging of the porous material, arises from the deposition of the extracted

removal of certain substances from solution and their condensation upon the surface of the finely divided solid is somewhat loosely termed adsorption. Further examination of the phenomenon has shown, however, that it is complex, involving not only a pure surface-concentration effect, but also a coagulation or flocculation of material at the surface, which may in turn be followed by chemical change in the material, *e.g.*, oxidation. In many cases also we find that the extracted material penetrates into the body of the absorbent substance. To cover both adsorptive and absorptive effects the non-committal term "sorption" has been suggested. That charcoal and presumably many other substances exert this twofold effect has been most clearly demonstrated by J. W. McBain (Phil. Mag. (6) 18, 916, 1909), in a paper entitled "The Mechanism of the Adsorption ('sorption') of Hydrogen by Carbon." McBain shows that the process takes place in two stages. At first there is an extremely rapid increase of concentration of the hydrogen in a very thin layer at the surface of the charcoal, and later there is a slow diffusion of the gas into the interior of the charcoal. It is only the first of these stages which may properly be called adsorption. Adsorption is therefore one of those terms which, after having been employed for many years to cover a variety of phenomena apparently similar in character, has attached to itself within recent years a much more restricted, but at the same time much more definite meaning. The result is that although the term is less comprehensive, its application is one of much greater precision, and therefore of more scientific value. The kind of phenomenon we are considering depends essentially upon the existence of a surface or interface separating two homogeneous phases. It is known that all such surfaces are characterised by a peculiar distribution of intermolecular forces, which give rise to surface-tension. These surfaces are also characterised by the existence of an electrical potential difference acting across the surface. Adsorption is primarily a capillary surface-tension phenomenon. When the electrical forces enter into the result, the extra effect produced is termed electrocapillary adsorption. It is theoretically possible to eliminate the latter effect or reduce it to negligible dimensions by working under conditions in which the pure capillary effects predominate.

—"Science Progress," October, 1916.

The District Gardens.

Record of Attendances.

Under the name of "District Gardens" most of the Model Gardens founded in 1908, and which were suspended by the action of a resolution of the Combined Court in March, 1915, have now been reconstituted. Below will be found the details of the attendances at these gardens from January, 1911, to the end of December, 1916. It will probably be a considerable time before the numbers approach those recorded for the Model Gardens as the increasing interest and confidence of parents, teachers and children received a rude shock—and these things are plants of slow growth.

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequebo.	Dem Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1911 ...	5,129	3,600	2,869	1,509	2,230	2,561	2,444	20,342
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,557
1915 ...	1,123	1,006	769	59	503	339	401	4,200
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the year 1916. The corresponding figures for the two previous years, and the averages for the four years previous to that, are added for convenience of comparison.

Product.	*Average 1910-13.*	*1914.*	*1915.*	*1916.*
Sugar, tons ...	92,569	107,137	116,223	101,649
Rum, gallons ...	2,566,424	3,489,729	4,698,230	4,386,854
Molasses, casks ...	1,534	832	...	...
Cattle-food, tons ...	6,727	2,426	2,233	997
Cacao, cwts. ...	467	445	532	416
Citrate of Lime, cwts.	18†	99	170	466
Lime Juice, conc., gals.	*	*	*	8,565
Essential Oil of Limes, gals.	*	*	*	290
Coconuts, thousands	987	1,890	2,090	1.631
Coconut Oil, gals....	7,500	20,082	22,059	17,948
Copra, cwts. ...	1,230	1,690	1,619	2,117
Coffee, cwts. ...	1,006‡	2,131	1,538	4.474
Kola-nuts, cwts. ...	5¶	4	17	26
Rice, tons ...	4,182	7,090	9,058	13.008
Ricemeal, tons ...	1,903	211	266	300
Cattle, head ...	959	1.172	619	622
Hides, No. ...	*4,880*	*4,646*	*4,581*	*4,597*
Pigs, No. ...	1,161†	1,303	1,193	1,160
Sheep, head ...	55†	111	12	69
Balata, cwts. ...	9,996	9,131	13,903	12,952
Charcoal, bags ...	69.928	67.150	58,124	53.527
Firewood, Wallaba, etc., tons ...	9,371	10,201	8,905	10.364
Gums, lbs. ...	3,594	886	...	1,118
Lumber, feet ...	336,758	254,772	225,453	360,439
Railway sleepers, No.	8,150†	10,627	2,556	5,525
Rubber, cwts ...	15‡	9	41	139
Shingles, thousands	2,567	1,806	2,214	2,355
Timber, cub. ft. ...	308,506	212,418	113,861	138,342

* No record available.
† *In 1912 and 1913 only.*
‡ In 1911, 1912 and 1913 only.
¶ In 1910 and 1913 only.

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I. The Carbohydrates of the Mangold Leaf.

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III The Mechanism of the Degradation of Starch in the Leaf.

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Report of the Government Chemist for 1915.

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"Journal of Agricultural Research," Oct. 23, 1916.

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